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(54) Integrated communications and navigation system

(57) In an integrated communications and navigation system 10 for a vehicle, a digital map display 17 generated from stored information 13, 14 is up-dated by transmissions via cellular radio links and the vehicle position, determined by NAVSTAR, is superimposed on the map.

Fig. 1.

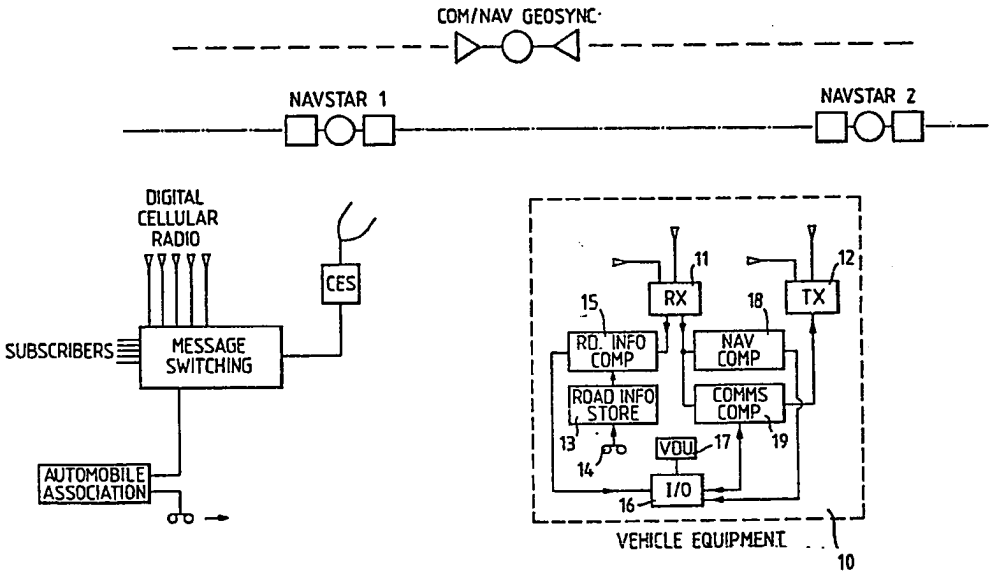

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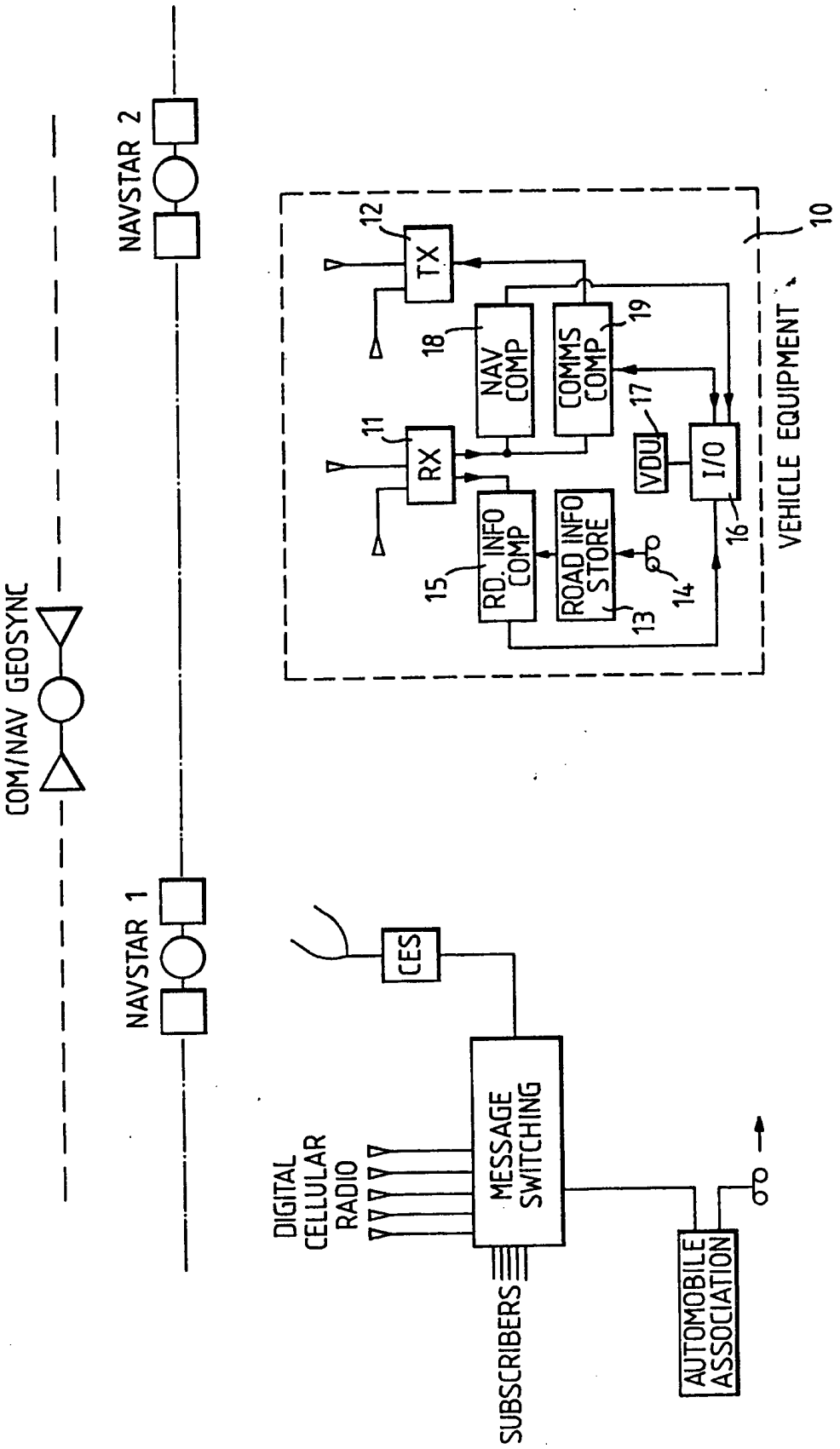
Fig. 1.


NAVSTAR 2
COM/NAV GEOSYNC
NAVSTAR 1
VEHICLE EQUIPMENT
10
TX
12
RX
11
NAV COMP
18
COMMS COMP
19
VDU
17
I/O
16
RD. INFO COMP
15
ROAD INFO STORE
13
14
CES
DIGITAL CELLULAR RADIO
MESSAGE SWITCHING
SUBSCRIBERS
AUTOMOBILE ASSOCIATION

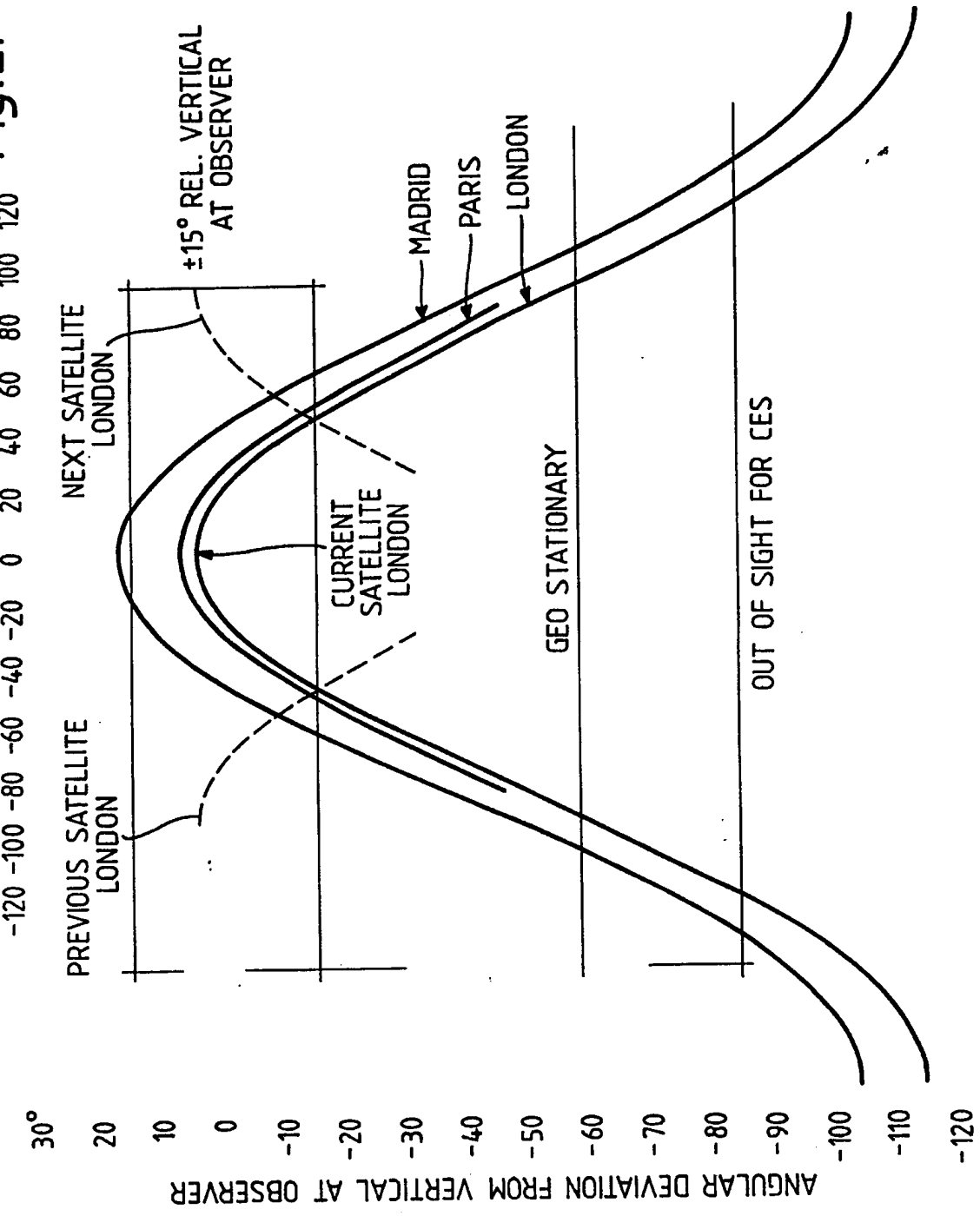

ANGULAR DEVIATION FROM VERTICAL AT OBSERVER
30° 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120
SATELLITE LATITUDE = 55 LOS φ
-120 -100 -80 -60 -40 -20 0 20 40 60 80 100 120
±15° REL. VERTICAL AT OBSERVER
NEXT SATELLITE LONDON
PREVIOUS SATELLITE LONDON
CURRENT SATELLITE LONDON
MADRID
PARIS
LONDON
GEO STATIONARY
OUT OF SIGHT FOR CES

Fig.2.

SPECIFICATION

Integrated communications and navigation system

This invention relates to an integrated communications and navigation system and is primarily but not exclusively directed to land vehicles.

In recent years there have been considerable developments in the generally unrelated fields of personal communications and vehicle navigation. In personal communications the advent of integrated solid state electronics has resulted in products such as cellular radio, radiopagers and radio telephones generally. Cellular radio in particular provides a ready means of communication between drivers and the public switched telephone network and is intended to cover the major portion of the country, both urban and rural, in the near future. The cellular radio system is ideally suited to providing drivers with up-to-date information, on request, regarding road conditions, details of major roadworks and diversions etc. At the same time considerable advances are being made in the use of artificial earth satellites for providing global navigation systems with ever increasing accuracy which can currently be utilised in vehicles and will, in the near future, even be available to individuals. Both geostationary and geosynchronous satellites can be used. The NAVSTAR system of geostationary satellites is currently under development and can provide extremely accurate navigation information for road users, inter alia.

The development of ever more dense electronics packages allows considerable data processing and storage capabilities to be contained within equipments which are readily installed in cars and commercial vehicles. It is known, for example, to provide a visual display unit in a vehicle on which map information can be displayed, such information being held in a digital store, e.g. a tape cassette.

According to the invention there is provided an integrated communications and navigation system for a vehicle comprising a radio receiver for satellite navigation signals, a microwave communications transceiver, a radio telephone communications transceiver and a digital map data storage, processing and display means, the map processing means being coupled to the navigation receiver and the communications transceivers whereby the vehicle position can be superimposed on a map display and the map information can be up-dated in response to information received via the communications receivers.

In a preferred embodiment of the invention the system includes means for processing and visually displaying digitally encoded messages received via a transceiver.

An embodiment of the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a block diagram illustrating an integrated communication and navigation system, and

Figure 2 illustrates the satellite view from an observer in London.

The integrated communications and navigation system for a vehicle is denoted generally within the dotted box 10, Figure 1. It includes radio receiving equipments 11 and transmitting equipments 12 suitable for (a) receiving satellite navigation signals from both geostationary and geosynchronous earth satellites, (b) receiving and transmitting digital signals via microwave links, and (c) receiving and transmitting messages via cellular radio links. In addition there is provided a map information store 13, which can receive input from e.g. a pre-recorded tap cassette reader 14. The map information is processed in a map computer 15 to drive, via an input/output interface 16, a visual display unit 17. A navigation computer 18 receives navigation information from earth satellites and computes the vehicle's current position. This position can be superimposed on the map display 17, via the interface 16. In addition the system can receive map modifying information via the receivers 11 which is used to modify temporarily the displayed map. The receivers can also receive digitally encoded messages which are decoded by a communications computer 19 for visual display. The vehicle operator can also transmit, either speech via the cellular radio or digitally coded messages via a keyboard in the interface feeding the message processor 19.

Consider the case of a commercial road vehicle. The driver obtains tape cassettes each holding digital data for producing a road map of a given area or a street map of a large city. The content of the cassette is read into the store 13 at the start of a journey and the processor 15 derives the map signals for the VDU. The navigation computer 18 meanwhile calculates the vehicles position and this is plotted and superimposed on the VDU map. The driver uses the microwave and/or cellular radio receivers to interrogate a road traffic information system. Relevant information is recieved and entered into the processor 15 and the VDU map is modified accordingly. For example information may be broadcast regarding severe localised congestion at some point in the map area, major roadworks on a motorway etc., requiring the driver to deviate from his planned route. The displayed map may be modified to take account of this. The driver can maintain voice contact with a base station to report his position and receive instructions. During the course of the journey his transient position can be determined by the navigation computer and constantly displayed on the VDU map.

It is advisable to utilise both geostationary satellites and satellites in inclined planes for navigation signals as well as communications paths since either on its own cannot provide complete and reliable coverage under all circumstances. Geostationary satellites generally have an uninterrupted line of sight view to a vehicle operating near the equator. Away from the equator, the view can be obstructed by hilly terrain or by tall buildings in an urban sitation. A system of geosynchronous satellites on the other hand, whilst requiring the sequential use of a number of satellites for a given vehicle location, does enable the vehicle to have frequent observations of a satellite even when operating in extreme latitudes or restricting terrain or urban conditions. Similarly the control earth station (CES) which is used to communicate with the vehicle via the satellites can operate satisfactorily via geosynchronous satellites when out of view of geostationary satellites. It is worth noting that the CES can be linked

to a public message switch serving the localised cellular radio system so that updating information provided by the automobile association information service can be relayed to the vehicle via the most suitable path at any given time. Figure 2 shows the angular deviation from the vertical from three receivers located in London, Paris or Madrid to a geosynchronous satellite orbiting in a plane inclined 55° relative to the equatorial plane.

The communications satellite is used in spread spectrum anode with the spreading code locked in time to that of the navigation satellites. It is then possible to navigate using the communications satellite plus some navigation satellites thus overcoming the problem that the navigation satellites are not always visible in sufficient quantity.

CLAIMS

1. An integrated communications and navigation system for a vehicle, the system comprising a radio receiver for satellite navigation signals, a microwave communications transceiver, a radio telephone communications transceiver and a digital map data storage, processing and display means, the map processing means being coupled to the navigation receiver and the communications transceivers whereby the vehicle position can be superimposed on a map display and the map information can be up-dated in response to information received via the communications receivers.

2. A system as claimed in claim 1, and including means for processing and displaying digitally encoded messages received via the microwave or the radio telephone transceivers.

3. A system as claimed in claim 1 or 2, wherein said map storage and display means includes a tape reader for receiving a digital input from a prerecorded tape.

4. An integrated communications and navigation system substantially as described herein with reference to and as illustrated in Figure 1 of the accompanying drawings.

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